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Resident doctors' perception and practice of resin-bonded bridges

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Abstract
Background: Resin bonded bridges (RBB) was introduced as an alternative to conventional bridges for tooth replacement under certain clinical conditions. It was designed as a temporary restoration which is reversible and the clinicians' major concern has been its longevity. The major cause of failure was attributed to de-bonding caused by complex multi- directional inter-abutment stresses associated with the 3-unit bridge that challenges the retainer and adhesive bond. The study aimed to assess the attitude, knowledge and practice of resident doctors on the performance factors of RBB.
Methods: A cross-sectional study conducted amongst residents at an update course using self –administered questionnaires. The first part of the questionnaire consisted of questions related to participants' socio-demographics, intended area of expertise, years of experience and percentage of RBBs performed in their clinical prosthodontic / restorative practice. The second part of the questionnaire comprised close-ended multiple-choice questions which were designed to extract the opinion and understanding of the respondents regarding performance factor for RBBs. The questions were related to clinical indications, prosthesis design etc
Results: Eighty percent of the participants indicated that had <10% tooth replacement service was done with RBB, 44.7% of the respondents considered RBB as a provisional restoration while 28 (36.8%) regarded RBB as both provisional and permanent restoration. About 76% of the respondents believe that perforated retainers were associated with clinical success of RBBs. 70% considered anterior maxilla as the most favorable location while class 1 jaw relation was preferred by 60% of participants
Conclusion: With less than 10% of teeth replacement done using RBBs, there is a need for continuing education opportunities for practicing dentists and better exposure of undergraduate and postgraduate students to clinical application of RBBs.

Keywords: *Perception, practice, resident doctors, resin bonded, bridges*

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Abstrait
Contexte : Ponts liant à résine (RBB) a été présenté comme une alternative aux ponts conventionnels pour le remplacement des dents dans certaines conditions cliniques. Il a été conçu comme une restauration provisoire réversible et la principale préoccupation des cliniciens est sa longévité. La principale cause de défaillance a été attribuée au décollement provoqué par des stresses complexes multidirectionnels inter-piliers associées au pont à 3 unités qui met au défi le dispositif de retenue et la liaison adhésive. L'étude visait à évaluer l'attitude, la connaissance et la pratique des médecins résidents en ce qui concerne les facteurs de performance de RBB.
Méthodes : Une étude transversale menée auprès des résidents lors d'un cours de mise à jour à l'aide de questionnaires auto-administrés. La première partie du questionnaire comportait des questions liées au développement sociodémographiques des participants, domaine d'expertise destiné, années d'expérience et le pourcentage de RBB effectuées dans leur clinique prothétiques / pratique réparatrice. La deuxième partie du questionnaire comporte des questions à choix multiples à extrémité fermée qui ont été conçus pour extraire l'opinion et la compréhension du répondant en ce qui concerne le facteur de performance pour RBB. Les questions portaient sur les indications cliniques, la conception de la prothèse, etc.
Résultats : Quatre-vingts pourcent des participants ont indiqué que <10% de service de remplacement de dent a été fait avec RBB, 44,7% des répondants considèrent RBB comme une restauration provisoire tandis que 28 (36,8%) ont considéré RBB comme la restauration provisoire et permanente à la fois. Environ 76% des répondants croient que les dispositifs de retenue perforés ont été associés à la réussite clinique de RBB. 70% considéraient le maxillaire antérieur comme l'emplacement le plus favorable, tandis que 60% des participants préféraient une relation de la mâchoire de classe 1
Conclusion : Avec moins de 10% des remplacements de dents effectués à l'aide de RBB, il est nécessaire que les dentistes praticiens puissent poursuivre leurs études et de mieux exposer les étudiants en licence et en maitrise à l'application clinique de RBB.

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Mots clés : *Perception et pratique des ponts liés en résine*

Introduction

Resin-bonded bridge (RBB) was first introduced in 1970's by Rochette as a replacement option for missing tooth/teeth instead of the conventional bridge. These restorations were originally retained through adhesion, but now minimal preparations of the abutment may be done to optimize mechanical resistance and retention forms. [1] Preparation designs for RBBs are limited to enamel and may comprise of palatal/ lingual veneer preparations, proximal boxes, vertical grooves, guide planes, or pinholes in the cingulum area.

The advantages of RBB include conservation of the tooth structure, can be reversible when used as a temporary or provisional restoration, pulp vitality is preserved, there is minimal interaction with soft tissue and can be retrieved easily [3-6]. However, since the introduction of RBBs, the clinicians' major concern has been its longevity. The major cause of failure was attributed to de-bonding caused by complex multi- directional inter-abutment stresses associated with the 3-unit bridge that challenges the retainer and adhesive bond. The abutment however should be restoration free or minimally restored, and the retainer should ideally cover any existing restoration completely. Any variation in the quality or quantity of enamel will have a significant effect on the bond strength [6]

All the design options that can be used for conventional bridge are possible for the RBB, cantilever, fixed-fixed, fixed –movable and hybrid. For the cantilever RBB, A 20% debond has been reported over a 27 month period highlighting its clinical potential [8]. In a study by Djemal et al, median survival of fixed-fixed designs was given as 7.8 years which is shorter than 9.8years for the cantilever design [11]. The higher rate of failure in the fixed-fixed design was thought to be due to differential abutment movement resulting in debonding of one retainer [11].

The clinical performance of RBBs depends on factors that can be classified as patient-related (e.g saddle span, location, remaining enamel, and parafunctional habit) design related (e.g retainer type, thickness, and connector height) and technique-related (e.g cement, retainer treatment and isolation method). In addition, a minimum retainer thickness of 0.7mm and a minimum connector height of 2mm have been recommended[12]. Appropriate teaching training and exposure of undergraduates as well as postgraduate students to RBBs will improve their clinical attitude and consequently the application of these restorations. In our environment, there is a dearth of study assessing RBBs performance factors. The aim of this study therefore was to assess the attitude, knowledge and practice of resident doctors on the performance factors of RBB.

Methodology

This cross-sectional study was conducted among postgraduate students during an update /revision course organized by the West African College of Surgeons at the University College Hospital Ibadan. Ethical approval was obtained from University of Ibadan/ University College Hospital ethical Review Committee.

A structured, self – administered questionnaires attached to the study description was used. The questionnaires were handed over to the class representative to eliminate bias to give to consenting participants and to be returned back to the class representative.

The first part of the questionnaire consisted of questions related to participants socio-demographics, intended area of expertise, years of experience and percentage of RBBs performed in their clinical prosthodontic or restorative practice. The second part of the questionnaire comprises of close-ended multiple-choice questions which were designed to extract the opinion and understanding of the respondent regarding the indications and basic requirements for RBBs. The questions were related to clinical indications, prosthesis design, retainer type and dimensions, retainer surfaces, tooth preparation, desired cements and clinical technique.

The last part of the questionnaire contained simple table and grid questions that was designed to identify the participants opinions regarding the significance level of vital factors related to the clinical success. These factors included; remaining abutment enamel, area of mouth where RBB is placed, number of missing teeth to be replaced, RBB design, type of retainer, retainer surface treatment, connector height, retainer thickness etc. The respondents could provide scores ranging from one to five (using a Likert scale), with a score of one indicating a factor was very insignificant, and a score of five Indicating a factor was very significant. Factors designated as insignificant, neutral and significant received scores of 2-4 respectively. Average significance was determined to identify the frequency, pattern and significance of the response variables identified. Data generated was entered into the computer using SPSS version 20.0 (Chicago, Illinois, USA). Chi-square tests were used to

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compare categorical variables and p value less than 0.05 was considered statistically significant.

Results

One hundred questionnaires were sent to the residents attending the update lectures. Eighty questions were returned out of which seventy six correctly filled questionnaires were entered into the computer. Participants age ranged from 30 to 50 years with a mean of 36.5± 5.8 (SD). There were 52 females and 24 males giving a male to female ratio of 1:2.2. A high majority (93.4%) were Christians, 63(82.9%) were married, and 47 (61.8%) have been practicing for 5-10 years, and 27(35.5%) for more than 10 years. About a third (31.6%) of the participants were undergoing residency training in Oral and Maxillofacial Surgery, followed by 10, 9 and 8 in Paediatric Dentistry, General Dental Practice and Conservative Dentistry respectively.

Table 1: Socio - demographs of Participants

Socio-demographs of Participants	Number (n)	Percentages (%)
Age Range	30 - 50	
Mean Age	36.5±5.8(SD)	
Sex		
Male	52	68.4
Female	24	31.6
Religion		
Christianity	71	93.4
Islam	5	6.6
Marital Status		
Single	12	15.8
Married	63	82.9
Widow	1	1.3
Year of Dental Practice		
< 5 years	2	2.6
5– 10 years	47	61.8
> 10 years	27	35.5
Proposed Specialty		
Oral Surgery	24	31.6
Pedodontics	10	13.2
GDP	9	11.8
Conservative Dentistry	8	10.8
Orthodontics	7	9.2
Community Dentistry	6	7.9
Periodontology	6	7.9
Oral pathology	5	6.6
Prosthodontis	1	1.3

Knowledge

Eighty percent of participants indicated that <10% replacement service was done with RBB. About 45% (44.7%) of the respondents considered RBB as a provisional restoration while 28 (36.8%) regarded RBB as both provisional and permanent restoration (Table 2).

Regarding design and mechanical factors associated with RBBs, 85.5% selected fixed- fixed as the most successful RBB design while 13.2% opted for cantilevers. For 58(76.3%) respondents, perforated retainers were associated with clinical success of RBBs. However, almost all (94.7%) respondents agreed that retainer surface treatment improves longevity. The optimum connector height selected by 53.9% of respondents was 2mm followed by 3mm (31.6%). For optimum retainer thickness, 0.5mm, was the most common (39.5%) choice followed by 0.7mm (14.5%) while 25 (32.9%) participants did not know the retainer thickness required.

However, 15 (19.7%) respondents did not consider retainer a factor that influences RBB longevity (Table 1). Thirty seven (48.7%) participants preferred that two teeth should be replaced by a RBB while 35.5% favored the use of one tooth. With regard to patient and technique

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Table 2: Participants responses to survey questions

RBBS	Number (n)	Percentages (%)
What % of your tooth replacement services have employed RBBs?		
< 10%	61	80.3
10 – 20 %	9	11.8
> 20%	6	7.8
What type of restoration you do consider RBB provide?		
Permanent	14	18.4
Provisional	34	44.7
Both	28	36.8
Does the amount of remaining enamel affect the success of RBBs?		
Yes	70	92.1
No	6	7.9
In which of the mouth are RBBs most successful?		
Ant Maxilla	53	69.7
Anti-Mandible	20	26.3
Post Maxilla	1	1.3
Post Mandible	1	1.3
No effect	1	1.3
How many missing teeth should be replaced for maximum longevity?		
One	27	
Two	37	
Three	10	
Four	2	
Which RBB design provides maximum longevity?		
Fixed	65	85.5
Cantilever	10	13.2
Which RBB retainer produces maximum longevity?		
Perforated	58	76.3
Non-perforated	13	17.1
Both are equal	5	1.6
Does retainer surface test increase RBB longevity?		
Yes	72	94.7
No	4	5.3
Does connector height affect longevity?		
Yes	65	85.5
No	11	14.5
What is the optimum height for a connector?		
1mm	6	7.9
2mm	41	53.9
3mm	24	31.6
4mm	5	6.6
Does preparing teeth for retentive features improve longevity?		
Yes	67	88.2
No	9	11.8
Which cement provides maximum longevity?		
RBC	65	72.4
GIC	21	27.6
Does use of rubber dam affect longevity?		
Yes	67	88.2
No	9	11.8
Does thickness of a retainer affect longevity?		
Yes	61	80.3
No	15	19.7

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What is the optimum thickness of retainer?		
0.3mm	4	5.3
0.5mm	30	39.5
0.7mm	11	14.5
1.0mm	6	7.9
Don't know	25	32.9
What type occlusion are RBB most successful?		
Class I	46	60.5
Class II	11	14.5
Class III	7	9.2
Have no effect	12	15.8

Table 3: Participants response related to significance of RBB performance factors

Factors	Very Insignificant (n %)	Insignificant (n%)	Neutral (n%)	Significant (n%)	Very Significant (n%)
Remaining abut enamel	8 (10.5)	-	2(2.6)	28 (36.8)	38 (50)
Area of the mouth where RBB is placed	5 (6.6)	3 (3.9)	1 (1.3)	34 (44.7)	33 (43)
Number of missing teeth to be replaced	5 (6.6)	-	**1 (1.3)**	25 (32.9)	45 (59.2)
RBB Design	4 (5.3)	-	3(3.9)	41 (53.9)	28 (36.8)
Type of Retainer	5 (6.6)	3 (3.9)	3 (3.9)	40 (52.6)	23 (32.9
Retainer Surface Treatment	5 (6.6)	1 (1.3)	10 (13.2)	40 (52.6)	20 26.3)
Connector height	4 (5.3)	3 (3.9)	11 (14.5)	43 (56.6)	15 (19.7)
Retainer thickness	2 (2.6)	3 (3.9)	16 (21.1)	42 (52.3)	13 (17.1)
Tooth preparation	7 (9.2)	1 (1.3)	11 (14.5)	34 (44.7)	23 (30.3)
Cement type	7 (9.2)	1 (1.3)	7 (9.2)	34 (44.7	27(35.5)
Use of RD during Cementation	5 (6.6)	2 (2.6)	11 (14.5)	33 (43.4	23 (32.9)

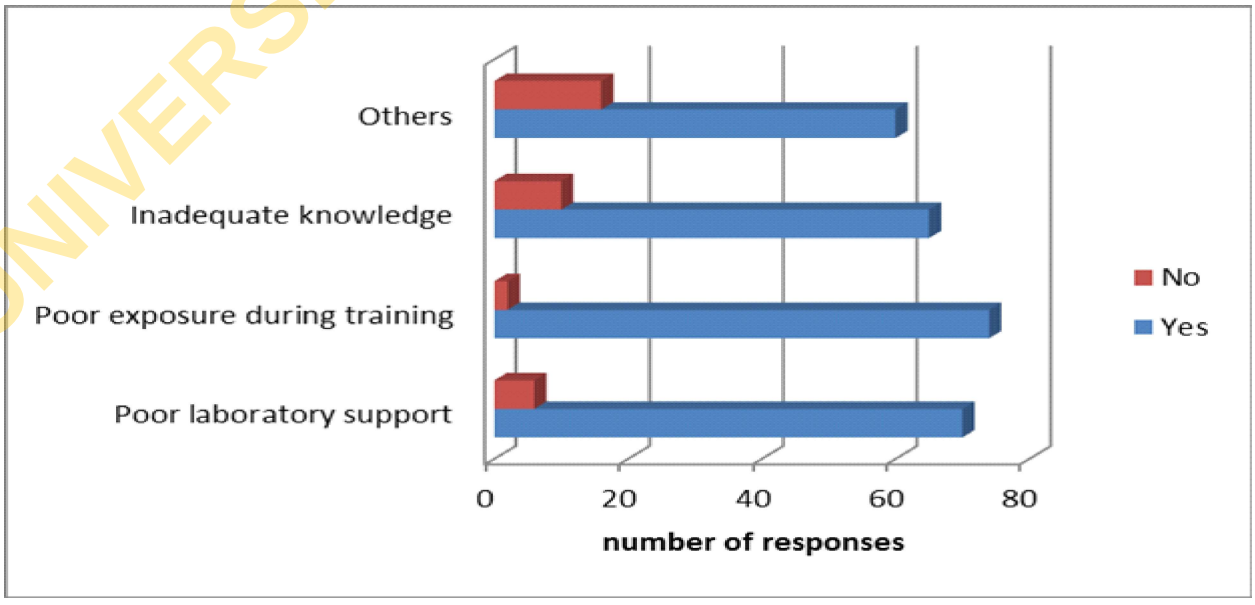

Fig 1: A bar chart
Participants' reasons for limited usage of RBBs in their practice

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related factors, a high majority (92.1%) accepted that remaining enamel structure influences the performance of RBBs. Aboout 53(69.7%) of participants considered the anterior maxilla the most favourable location for achieving a successful RBB followed by anterior mandible in 20 (26.3%) participants. Class I jaw relation was also the most preferred in 46 (60.5%) respondents, although 15.8% believed that occlusal classification does influence RBB performance. Sixty five respondents selected Resin bonded cement (RBC) as the first choice for RBB cementation. Considering the use of rubber dam (RD) in RBB, 67 respondents agreed that the use of RD increase the longevity of RBB (Table 2). Overall, the factors considered significant as affecting the success of RBB include connector height which ranked the highest proportion (43, 56.6%) followed by retainer thickness (42, 55.3%), RBB design (41, 53.9%) and equal proportion for type of retainer and retainer surface treatment (40, 52.6%). Forty- five respondents considered number of missing teeth to be replaced and very significant in the success of RBB.

Practice

About 80% of respondents employed RBB for less than 10% of teeth replacement. Each participants gave more than one reason for limited usage. Reasons given included, poor exposure during undergraduate as well as postgraduate trainings accounting for 97.3% of the cases followed by poor laboratory support in 92.1%. Other reasons given included poor retention, technique sensitive and compromised aesthetics.

Discussion

The response rate in this study was 76% which compares favourably with 78% recorded in the Saudia Arabia study [13] and lower than 100% reported in Yemen [14]. The fact that only (61.8%) of the participants in this study had practiced for 5 – 10 years is due to the fact that they are resident doctors training to become specialists. This is higher than 49.3% and 46.9% reported in a study in Saudi Arabia among specialists and General Dental Practitioners who have more than 10 years of clinical practice .[13]

Most of the respondents (80%) indicated that RBBs were employed in less than 10% of tooth replacement services provided. Various reasons given for limited use of RBB include poor laboratory support, poor exposure during both undergraduate and postgraduate trainings, inadequate knowledge and concern regarding their longevity etc. which also account for why 44.7% of respondents consider RBB as a temporary restoration. It has been widely reported that RBBs are successful as cantilevers than as fixed restorations [15-18], even though a high number of dentists use fixed-fixed designs and double abutments [19].

The cantilevers, is usually preferred due to the avoidance of different movement of the abutment teeth when fixed-fixed designs are used [20]. In this study 85.5% selected fixed-fixed as the design of choice. This is far higher than 38% reported in a study in Bristol Dental hospital where the survival characteristics of 771 resins- retained bridges was considered. The reason for considering fixed-fixed design in this study may be due to concerns over stability of tooth position and also due to the nature of Nigerian diets which are mainly fibers which translates to more occlusal load on the retainers. The original resin bonded fixed partial denture (RBFPD) frameworks were perforated to enhance mechanical retention of the cement to the framework. The disadvantage of this design however that is the perforation weakens the framework strength and the resin is exposed to potential abrasion/leakage through exposure to the oral cavity. Slightly over three quarter (76.3%) of the respondents in this study were of the opinion that perforated retainers is associated with clinical success of RBBs. The low level of respondents' knowledge in this regard may be due to inadequate exposure to the use of RBBs.

However, a high majority (94.7%) of the respondents know that retainer surface treatment improves longevity. Treatment of retainers fitting surface has evolved over the years beginning from electrolytic etching introduced by Livaditis and Thompson. [21] to airborne abrasion with aluminium oxide and eventually to coating the metal fitting surface with silane [1]. Considering connector height, about 85% of respondents indicated a height of 2-3mm to be adequate which is consistent with previous studies [22,23] while only about forty five percent selected < 0.7mm as the optimum thickness for the retainer, which is close to what was reported by Vohra and Al-Qahlani [13]. The need for tooth preparation for RBB is controversial. An earlier research advocate the use of the more extensive preparations to enhance retention [22].

However, most studies now advocate minimal preparation within enamel [11] or no preparation at all. [2] Preparation involves irreversible damage to abutment teeth for what is reported to be only a limited benefit, and even when minimal preparation is to be done, dentine exposure may occur with resultant dental hypersensitivity.

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Moreso, bond strength to dentine is lower than to enamel to achieve maximum retention. In this study, almost all except 7.9% accepted that remaining enamel structure were important for RBB success longevity. Creugers *et al* reported that anterior resin bonded prosthesis have higher durability. In the present study, about 70% of respondents considered anterior maxilla as the most favourable location for achieving a successful RBB. This is similar to what was reported by previous studies [4,13]. This however is at variance with some studies that reported that resin bonded prostheses placed in the maxilla are more likely to fail compared with those in the mandible [22,24].

Development in resin cements have helped to increase restoration longevity. Panavia (Karrary Co. Ltd. Osaka, Japan), a RBC demonstrated prolonged high bond strengths due to the formation of chemical bond between phosphate group of the cement monomer and the oxide layer of the mental retainer [24]. It is therefore not surprising that almost three quarter of the respondents selected RBC as the first choice for cementation of RBB. Moisture control is essential to optimal bonding.

Application of rubber dam is the most predictable method of preventing contamination during cementation. In this study, about 88% considered rubber dam (RD) use to increase longevity. This is in agreement with previous studies [13,25,26] where the use of RD was considered the gold standard as it provides the best possible chance of survival. However, King *et al* [20] in their study reported that RBB bridges cemented under rubber dam were almost twice as likely to fail compared with those that were not. This was because undergraduate dental students with limited clinical experience provided majority of the bridges.

In this study, connector height was rated the highest as being the significant factor affecting RBB success followed by RBB design, type of retainer, retainer surface treatment, and retainer thickness in descending order were considered as significant factors affecting success of RBB. This is at variance with the study by Djemal *et al* [11] where patient selection, design, mechanical features and clinical techniques were considered important performance factors for RBB.

Conclusion

The inadequate knowledge of the respondents and other factors relating to performance of RBBs may be responsible for the negative perception and low rate of utilization in our environment. Therefore, there is a need for continuing education opportunities for practicing dentists and better exposure of undergraduate and postgraduate students to clinical application of RBBs

References

1. Ulna Lally. Resin –bonded fixed partial dentures past and present – an overview. J Irish Dent Assoc 2013, 58 (6): 294-300.
2. Ibbetson R. Clinical considerations for adhesive bridge work. Dent Update 2004, 31:254-265.
3. Pjetursson BE, Tan WC, Tan K, Bragger U, *et al*. A Systematic review of the survival and complication rates of resin- bonded bridges after an observation period of at least 5 years. Clin Oral Implants Res 2008; 19: 131-141.
4. Howard-Bowles E, McKenna G and Allen F. An evidence based approach for the provision of resin-bonded bridgework. Eur J.Prosthodont Restor. Dent 2011; 19: 99-104.
5. Mieltinen Mimillar BJ. A review of the success and failure characteristics of resin –bonded bridges. Br Dent J 2013; 215: 76-77.
6. Sanjeev M, Sandeep Garg, Navsharanjit K C and Monika J. Resin bonded bridge: Conservative Treatment option for Single Tooth Replacement. J Clin Case Rep 2013; 3: (3)
7. Dalin AV, Feilzer AJ and Kleverlaan CJ. A Literature review of two-unit cantilever FPDs. Int J Prosthodont 2004; 17: 281-284.
8. Briggs P, Dunne S and Bishop K. The single unit, single retainer, cantilever resin-bonded bridge. Br Dent J 1996; 181: 373-379.
9. Bothelo MG, Nor LC, Kwong HN and Kuein BS. Two-unit cantilever resin-bonded fixed partial dentures- a retrospective, preliminary clinical investigation. Int J Prosthodont 2000; 13: 25- 28.
10. Clare M, Serpil D and Graham G. Predictable Resin Bonded Bridges in General Dental Practice. Dental Update. 2001; 28:501-508.
11. Djemal S, Setchell D, King P and Wickersi J. Long-term survival characteristics of 832 resin retained bridges and splints provided in a post-graduate teaching hospital between 1978 and 1983. J Oral Rehab 1999; 26: 302-320.
12. Ibrahim A A, Byine D, Hussey DI and Claffey N. Bond strengths of maxillary anterior base metal resin-bonded retainers with different thickness. J Prosthet Dent 1997; 78:281-285.
13. Vohra FA and Al-Qahtani MA. Attitude and awareness of dentists towards resin bonded bridges in Saudi Arabia. Saudi Dent J 2014;26:96-102.

UNIVERSITY OF IBADAN LIBRARY

14. Madfa AA, Al- Hamzi MA, Al Sanabani FA and Al-Anesi WA. Knowledge of Yemeni Dental Practitioners towards Resin Bonded Prosthesis. EC Dental Science 2017;10(2):46-52
15. Chan AW and Barnes IE. A prospective study of cantilever resin bonded bridges; an initial report. Aust Dent J 2000;45:31-36.
16. Olin PS, Hill EM and Donahue JL. Clinical evaluation of resin- bonded bridges: a retrospective study. Quintessence Int 1991;22:873-877.
17. Van Dalen A, Feilzer AJ and Kleverlaan CJ. A literature review of two-unit cantilevered fixed partial dentures. Int J Prosthodont 2004;17:281-284.
18. Ken M. Clinical long term survival of two retainer and single –retainer all ceramic resin bonded fixed partial dentures. Quintessence Int 2005; 36:141-147.
19. Patsiatzi E and Grey NJ. An investigation of aspects of design of resin bonded bridges in general dental practice and hospital services. Prim Dent Care 2004;11: 87-89.
20. King PA, Foster LV, Yates RJ, Newcombe RG and Garrett MJ. Survival characteristics of 771 resin retained bridges provided at a UK dental teaching Hospital. Br Dent J 2015;218(7):423-427.
21. Livaditis GJ, Thompson VP. Etched castings, an improved retentive mechanism for resin-bonded retainer. J Prosthet Dent 1982; 47:52-58..
22. De Kanter RJ, Creugers NH and Verzijdenco VantHorf MA. A five year multipractice clinical study on posterior resin –bonded bridges. J Dent Res 1998; 77:609-614.
23. Baltelha M. Design principles for cantilevered resin-bonded partial dentures. Quintessence Int 2000; 31: 613-619.
24. Zalkind m et al. Resin bonded fixed partial denture retention: A retrospective 13 year follow-up. J Oral Rehabilitation 2003; 30 (10):971-977.
25. Durey KA, Nixon PJ, Robinson S and Chan MF. Resin bonded bridges: techniques for success. Br Dent J 2011; 211 (3):113-118.
26. Gilbert GH, Litaker MS, Pihlstrom DJ, Amundson CW and Gordan V.V. Rubber dam use during routine operative dentistry procedures: findings from the Dental PBRN. Oper Dent 2010; 35(5):491-499.

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